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YOUNGEST OCCURRENCE OF THE GENUS *MICROPHORITES* (DIPTERA: DOLICHOPODIDAE): A NEW SPECIES IN LATE CRETACEOUS VENDEAN AMBER

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ABSTRACT

A new species of the extinct genus *Microphorites* Hennig (Dolichopodidae: Microphorinae) is described from a single male preserved in Late Cretaceous (Cenomanian to Santonian) Vendean amber (NW France). *Microphorites magaliae* n. sp., is mostly characterized by large compound eyes, flagellomere I with base bulbous and abruptly tapering to slender apex, thorax strongly hump-backed, with numerous acrostichal and dorsocentral setae, including a pair of elongate posterior setae on the mesoscutum, mesoscutellum with two long strong setae, wing vein C terminating just beyond R_{4+5}, and R_{4+5} approximately equidistant between R_{2+3} and M_1 along wing margin. It is the latest occurrence of the genus which is otherwise known exclusively from Early to mid-Cretaceous amber of Lebanon, Spain, and southwestern France. The existing key to all species of *Microphorites* is modified to include the new species.

Keywords: Insecta, Empidoidea, Microphorinae, Cretaceous, France

RÉSUMÉ

Une nouvelle espèce du genre fossile *Microphorites* Hennig (Dolichopodidae: Microphorinae) est décrite à partir d'un mâle fossilisé dans l'ambre crétacé supérieur (Cénomanien à Santonien) de Vendée (nord-ouest de la France). *Microphorites magaliae* n. sp., est caractérisé par de grands yeux composés, le flagellomère I bulbeux à sa base et se rétrécissant brusquement vers l'apex, le thorax fortement bosselé, avec de nombreuses soies acrostichales et dorsocentrales, y compris une paire de soies postérieures allongées sur le mésoscutum, le mésoscutellum avec deux soies épaisses et longues, l'aile avec la nervure C se terminant juste au-delà de R_{4+5}, et R_{4+5} approximativement équidistante de R_{2+3} et M_1 le long de la marge de l'aile. Il s'agit de la plus récente occurrence du genre connu autrement des ambres du Crétacé inférieur et moyen du Liban, d'Espagne, et du sud-ouest de la France. La clé des espèces de *Microphorites* est modifiée pour inclure la nouvelle espèce.

Mots-clés: Insecte, Empidoidea, Microphorinae, Crétacé, France

INTRODUCTION

The family Dolichopodidae, or long-legged flies, is the world's fourth largest dipteran family and one of five major lineages within the superfamily Empidoidea. The traditional concept of the family comprises 15 subfamilies and is referred to as Dolichopodidae *s. str.* This concept was expanded to Dolichopodidae *s.lat.* to include Microphorinae and Parathalassiinae (Sinclair & Cumming, 2006), two small subfamilies for a time placed in Empididae (Negrobov, 1978; Evenhuis, 1994), but also considered at family rank by some authors (Chvála, 1983; Moulton & Wiegmann, 2004) or left unplaced as sister to Dolichopodidae (Hennig, 1971; Moulton & Wiegmann, 2007). Indeed, both clades have dolichopodid characteristics such as the Rs vein originating at or near the level of crossvein h, crossvein r-m situated in the basal fourth of the wing, and the male

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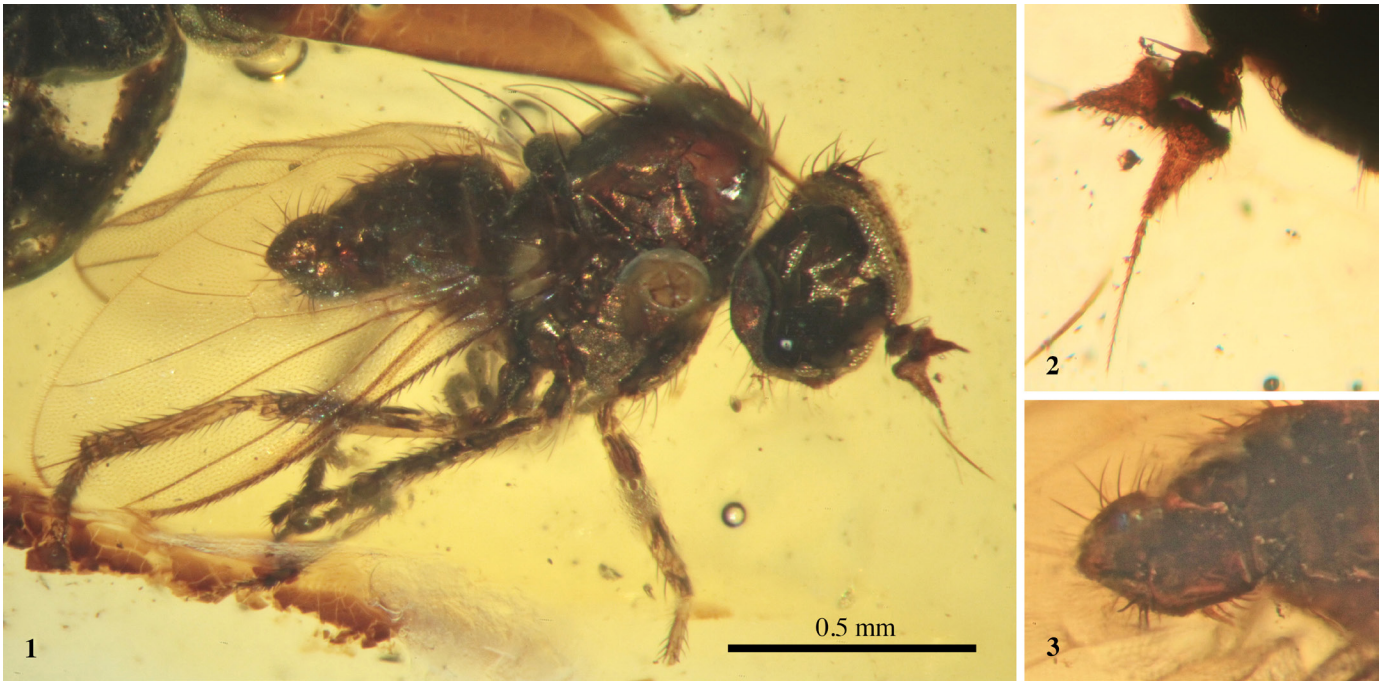

Figure G1. *Microphorites magaliae* n. sp., holotype male IGR.GAR-106a, in Late Cretaceous amber of Vendée, NW France. *1*, habitus in right lateral view; *2*, detail of antennae; *3*, detail of the genitalia.

terminalia rotated forward beneath the preceding segments of the abdomen (Wiegmann, Mitter, & Thompson, 1993). Microphorinae and Parathalassiinae are distinguished from other dolichopodids by the presence of an additional basal crossvein (bm-cu) and crossvein dm-cu connected to the base of M_2. Recent molecular analyses even suggest that Parathalassiinae are part of Dolichopodidae *s.str.*, with Microphorinae as sister group to the latter (Germann & others, 2011).

The subfamily Microphorinae is comprised of the modern genera *Microphor* Macquart and *Schistostoma* Becker and the extinct genera *Avenaphora* Grimaldi & Cumming and *Microphorites* Hennig, with the fossil record extending back to the Early Cretaceous. *Microphorites* is the most speciose one of the extinct genera and is known exclusively from the Cretaceous. The new fossil described here is the sixth species of *Microphorites*, and the latest occurrence of the genus which was otherwise known exclusively from Early to mid-Cretaceous amber of Lebanon, France, and Spain (Hennig, 1971; Grimaldi & Cumming, 1999; Nel & others, 2004; Arillo, Peñalver, & Delclòs, 2008).

MATERIAL AND METHODS

The material is comprised of one specimen preserved in a small sliver of clear yellow amber with one Hymenoptera (Serphitidae: *Serphites fannyae* Engel & Perrichot, 2014: 10J in this volume) as a syninclusion. The specimen is almost complete, missing only the tibia and tarsomeres of the right foreleg. It exhibits a minor taphonomic collapse of the compound eyes (Fig. G1.1). The amber was collected in 2002 by Magali Weigandt and Fanny Dupé from a deposit which was temporarily exposed during works along the D32 road between La Garnache and Challans, in the department of Vendée, northwestern France. The exact age of the amber-bearing stratum remains uncertain within the Middle Cenomanian to Early Santonian interval (Late Cretaceous, 97–85 Ma), as discussed by Perrichot and Néraudeau (2014: 10A in this volume)

The piece of amber was slightly polished on all sides to remove the weathered opaque surface and to facilitate the examination of the inclusions. Drawings were carried out under both incident and transmitted light with a camera lucida attached to a Leica MZ APO stereomicroscope. Photographs were taken with a Canon 5D Mark II camera attached to the stereomicroscope, and image stacks were merged using HeliconFocus 5.3 software (Helicon Soft Ltd.). Measurements were taken with an ocular graticule. The piece of amber was eventually embedded in a block of epoxy resin which was in turn polished on all sides.

SYSTEMATIC PALEONTOLOGY

Family DOLICHOPODIDAE Latreille, 1809
Subfamily MICROPHORINAE Collin, 1960
Genus MICROPHORITES Hennig, 1971

Type species.—Microphorites extinctus Hennig, 1971, p. 16, figs. 2, 3, 19–25.

Included species.—Microphorites deploegi Nel & others, 2004, *M. extinctus* Hennig, 1971, *M. magaliae* Perrichot & Engel, n. sp., *M. oculeus* Grimaldi & Cumming, 1999, *M. similis* Grimaldi & Cumming, 1999, *M. utrillensis* Peñalver in Arillo, Peñalver, & Delclós, 2008.

The generic diagnosis by Grimaldi and Cumming (1999), with supplements by Nel and others (2004), is followed.

MICROPHORITES MAGALIAE new species
Figures G1–G2

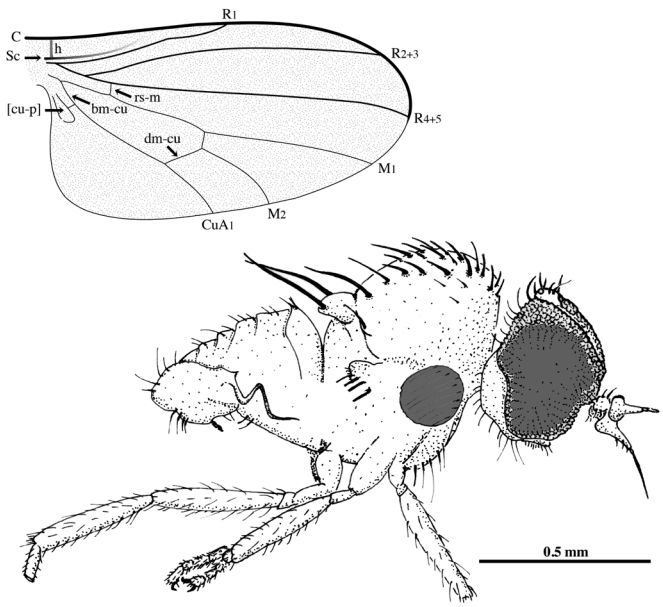

Figure G2. *Microphorites magaliae* n. sp., holotype male IGR.GAR-106a, in Late Cretaceous amber of Vendée, NW France; wing venational nomenclature and lateral habitus with no wings to show the typical male genitalia.

Type material.—Holotype male, IGR.GAR-106a (ex coll. Weigandt), in Late Cretaceous (Middle Cenomanian to Early Santonian, 97–85 Ma) Vendean amber; deposited in the Geological Department and Museum of the University Rennes 1, France.

Type locality.—La Robinière, departmental road D32, about 2.5 km south-west of La Garnache, Vendée, France.

Etymology.—The specific epithet is a matronym honoring Magali Weigandt who collected the amber piece containing the specimen.

Diagnosis.—The new species has the following unique combination of characters within the genus: compound eyes encompassing most of head, touching each other along inner margins, bare; flagellomere I with bulbous base and abruptly tapering to slender apex; thorax strongly hump-backed; mesoscutum with pair of elongate posterior setae; mesoscutellum with two strong, elongate setae; wing vein C terminating just beyond R_{4+5}; and R_{4+5} approximately equidistant between R_{2+3} and M_1 along wing margin.

Description.—Male. Total body length 1.30 mm; wing length 1.23 mm, maximum width 0.51 mm; flagellomere I length 0.11 mm, maximum width (basally) 0.70 mm; arista length 0.16 mm, basal aristomere length 0.01 mm.

Head large, spherical (Fig. G1.1); compound eyes holoptic (dorsal and ventral facets not differentiated), with inner margins touching for most distance anteriorly to ocellar triangle; gena present only by narrow strip. Antenna aristate, with fine microtrichiae; pedicel cup-like, with apical marginal ring of fine setae; flagellomere I long, with bulbous base, then abruptly tapered, apical portion long, slender, almost tubular by apex (Fig. G1.2); arista two-segmented, basal aristomere very short, apical aristomere elongate. Ocellar triangle prominent, with pair of moderately elongate setae anteriorly, two pairs of short setae posteriorly. Dorsal row of 16 postocular setae progressively decreasing in size laterally: median pair long, stiff and curved; lateralmost setae short, fine and straight. Six elongate, fine setae posteroventrally on each side of mouthparts. Proboscis either retracted or reduced, not visible.

Thorax. Notum strongly hump-backed, with two median rows of 6–7 fairly long acrostichal setae, two rows of 6–7 dorsocentral setae, two posteriormost setae elongate; anterior face of notum with pair of short, stiff setae directed forward; postpronotal lobe with long, upright seta; row of 3 long notopleural setae; mesoscutellum prominent, with one pair of elongate (0.27 mm long) stiff setae. Legs long, slender, bristly; each coxa with a ventral row of 4–5 long setae; hind femur with dorsal longitudinal row of erect setae, proximal setae longest; tibiae, particularly metatibiae, densely covered by erect setae.

Wing broadly rounded at apex (Fig. G2); vein C terminating just beyond R_{4+5}; Sc curved posteriorly towards R_1, not contacting R_1 along length but closely parallel, apically nebulous such that it appears to terminate before C; Rs originating just immediately beyond tangent with crossvein h (= c-sc); R_{2+3} slightly shorter than R_{4+5}, the latter reaching to wing apex and near midpoint between R_{2+3} and M_1; rs-m in basal quarter of forewing, about 1.75x its length from R_{2+3}-R_{4+5} fork; M_1 straight; M_2 present; bm separated from dm by distinct and complete bm-cu; CuA_1 straight; CuA_2 arched posteriorly, joining A_1 and creating small basal cell [cu-p]; short A_2 present as nebulous furrow; anal lobe rounded.

Abdomen short, less than 0.5x wing length. First five pregenital segments each with 6–8 erect setae dorsally. Hypopygium large, rounded, rotated and lateroflexed to right (Fig. G1.3, G2); posterior half strongly setose; left lamella with rounded dorsal lobe, apex of lobe with hooked tooth; right lamella with small dorsal flange; phallus long, curled.

DISCUSSION

Placement of this species within *Microphorites* is easily established owing to the bare compound eyes, wing with complete crossvein bm-cu, and antenna with two-segmented arista. Given the discovery of a species of *Microphorites* in Cenomanian–Santonian amber, thereby pushing the lineage into the Late Cretaceous, the genus should be sought in other deposits of similar age. For example, it seems possible that the genus may be discovered eventually in the Campanian amber of Canada or Turonian of New Jersey, both rich sources of Late Cretaceous insect inclusions and in close paleogeographic proximity to those Eurasia localities. The mid-Cretaceous amber of Myanmar and Santonian amber of Siberia are also strong candidates to eventually reveal species of *Microphorites*, unless, of course, the genus had a more restricted distribution which confined species to the western archipelagos and landmasses of Eurasia during this period. Hopefully, continued paleoentomological investigation will give us a greater understanding of the biogeography and phylogenetic relationships of the genus.

The following key, updated from that of Arillo, Peñalver, and Delclòs (2008), will permit recognition of *M. magaliae* from its congeners. It applies to both males and females although all but one species (*M. deploegi*) are known by a single gender only. The size of the compound eye relative to the head, as proposed in Arillo's key, was removed because it appears to vary between male and female of a same species, i.e. males have larger eyes than females.

Key to species of *Microphorites*

1. Basal flagellomere abruptly tapered, with base bulbous and tubular apex 2
   Basal flagellomere more evenly tapering from base to apex 3
2. Wing vein C terminating at R_{4+5}; R_{4+5} closer to M_1 than to R_{2+3} along wing margin; mesoscutum without posterior pair of strong, elongate setae [Barremian; Lebanon] ..... *M. oculeus* Grimaldi & Cumming
   Wing vein C terminating just beyond R_{4+5}; R_{4+5} approximately equidistant between R_{2+3} and M_1 along wing margin; mesoscutum with posterior pair of strong, elongate setae [Cenomanian–Santonian; France] ..... *M. magaliae* Perrichot & Engel n. sp.
3. Wing vein C terminating beyond R_{4+5} 4
   Wing vein C terminating at R_{4+5} [Barremian; Lebanon] ..... *M. similis* Grimaldi & Cumming
4. Antennal arista long, around twice basal flagellomere length; forewing vein R_{2+3} barely shorter than R_{4+5} 5
   Antennal arista short, as long as basal flagellomere; forewing vein R_{2+3} clearly shorter than R_{4+5} [Lower Albian, Spain] ..... *M. utrillensis* Peñalver in Arillo & others
5. Four strong setae on mesoscutellum [Barremian; Lebanon] ....*M. extinctus* Hennig
   Two strong setae on mesoscutellum [Upper Albian; France] .... *M. deploegi* Nel & others

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